DOCUMENT RESUME

ED 468 202 SE 066 582

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TITLE	Significance of Ethnomathematical Research: Towards International Cooperation with the Developing Countries.
PUB DATE	2002-04-00
NOTE	12p.; Paper presented at the Biennial International Conference on Mathematics Education and Society (3rd, Helsingor, Denmark, April 2-7, 2002).
PUB TYPE	Reports - Descriptive (141) -- Speeches/Meeting Papers (150)
EDRS PRICE	EDRS Price MF01/PC01 Plus Postage.
DESCRIPTORS	*Ethnomathematics; Curriculum; Elementary Secondary Education; Equal Education; Foreign Countries; Mathematics Education; *Multicultural Education

ABSTRACT

Development assistance was started for the sake of reconstruction of Europe shattered by World War II, and turned its attention to north- south problems starting at the Development Decade by the United Nations in 1960. In spite of all the efforts the international community has made, the situation for poor countries seems to have worsened and many insurmountable problems still lie ahead. "World Declaration on Education for All" (UNESCO, 1990) has changed the course of international cooperation and intends to address this global issue with attention to education as human rights and the potentiality of local culture. Verb- based curriculum in this paper is meant to activate the potentiality contained in ethnomathematical activities based upon the idea of universal activities, and substantiates the basic learning needs described in the declaration. (Contains 21 references.) (Author/MM)

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Significance of Ethnomathematical Research: Towards International Cooperation with the Developing Countries

by
Takuya Baba

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Significance of ethnomathematical research: Towards international cooperation with the developing countries

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Development assistance was started for the sake of reconstruction of Europe shattered by the World War II, and turned its attention to north-south problem starting at the Development Decade by United Nations in 1960. Despite of all efforts, which international community has made, the situation for poor countries seems to have worsened and many insurmountable problems still lies in front of us. World Declaration on Education for All (UNESCO, 1990) has changed the course of the international cooperation, and it intends to deal with this global issue with an attention to the education as human rights and to the potentiality of local culture. Verb-based curriculum in this paper is meant to activate the potentiality contained in ethnomathematical activities based upon the idea of universal activities, and substantiates the basic learning needs described in the declaration.

Introduction

International cooperation is another expression of development assistance which deals with development as a global issue. Besides international trades and travels, billions of dollars[1] flows from the north to the south every year. The flow implies mainly capital assistance to build roads, bridges, schools, etc. but more fundamentally for development, the technical assistance as a part of international cooperation is conducted to transfer technology from technically advanced country to technically lagged country. As a result, the latter is assumed to catch up finally the former in terms of technology, and thus industry and economy.

Currently, for the sake of technical cooperation Japan dispatches experts to the developing countries in such fields as agriculture, health and engineering. And cooperation in education, especially in basic education, that promotes economic and social development is now focused as one of key areas. The basic education, however, forms foundation of a person and at large foundation of a nation, and thus it is naturally very important but at the same time very sensitive to deal with. For example, the Kenyan society recognises the difference in objectives, contents, methods and attitudes between the modern education brought by the colonial government and the traditional education developed by tribal societies. The cultural conflict between those two education systems is called Asomi (Kenya, 1976, p.9) that expresses the psychological disposition for children to despise the local culture after being given modern education. This was taken up seriously by the Kenyan government since it seemed to affect very foundation of the country. To a certain extent, this is the common problem for

[1] 21 members of DAC have contributed 51.52 billion dollars in 1998.

P. Valero & O. Skovsmose (2002) (Eds.). Proceedings of the 3rd International MES Conference. Copenhagen: Centre for Research in Learning Mathematics, pp. 1-10.

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the countries that were forced to adapt modern education system exogenously in the process of colonisation.

In mathematics education, researchers such as Gerdes (1990) and Berry (1985) have warned against the situation in which the foreigners are involved in creation of a curriculum for a certain country or for an ethnic group. The reasons for it varies from (i) violation of sovereignty of nation at the political level to (ii) insensitivity to the local culture at the psychological level. Although mathematics is regarded as having universality, the second reason shows that a cultural aspect affects the learning of mathematics, and many mathematics educators conducted research on it. One culmination of such research movements is a proposal of ethnomathematics by D'Ambrosio (1985).

In this cultural sensitive situation, is it a meddling from unnecessary kindness or a new type of colonization to be involved in mathematics education in the other country in the name of international cooperation? The cultural sensitivity, however, implies neither avoidance of discussion with other cultures nor indifference to them and to the situation, which they are in. Rather, it is important to find out which points are common and which points are different across cultures. Therefore, in this paper, the author discussed the historical development and present situation of international cooperation, and then analyzed its issues from the perspectives of ethnomathematical research and verb-based curriculum.

Historical account of international cooperation in education

Overview of international cooperation in education

International cooperation in the sense of development assistance originated from assistance to reconstruction of Europe devastated by the World War II. After having succeeded in it, United Nations proposed the first UN Development Decade to tackle the North-South problem. It is around 1960 when the international cooperation started in the area of education, and UNESCO initiated the movement to make an educational plan to respond to necessity of newly independent countries in Asia, Africa, and Latin America. They intended to construct the modern education system and gathered in Karachi (1959), Addis Abeba(1961), Santiago(1961), and compiled respectively Karachi plan(1961), Addis Abeba plan(1961), Santiago plan(1962). The Table 1 shows tendency of the gross enrolment rate since then. The universal primary education, which was targeted to attain by 1980 in the plans, has not yet been achieved especially in low income countries.

Country income level	1965	1970	1975	1980	1985
Low(excluding China and India)					
Gross enrollment ratio	44.1	47.9	61.7	67.0	67.3

Females (percent)	38	41	42	42	43
China and India					
Gross enrollment ratio	94	85	106	101	110
Females (percent)	38	42	42	43	43
Lower middle					
Gross enrollment ratio	73.8	79.7	84.7	99.7	100.9
Females (percent)	44	45	45	46	47
Upper middle					
Gross enrollment ratio	95.4	105.5	98.3	102.3	103.3
Females (percent)	47	48	47	48	48
High					
Gross enrollment ratio	104.0	103.5	101.2	101.1	101.2
Females (percent)	48	49	49	49	49

Table 1 Enrolment rate per income level (taken from Lockheed et al., 1991, p.27)

Besides this quantitative aspect, we now would like to overview from qualitative aspect what has happened in educational development between the time of plans and the present time.

In 1960s, it was assumed that the development would be enabled by technical transfer from the technically advanced countries to the technically lagged countries, which was supported by modernization theory and human resource theory. And unavoidably the international cooperation was focused on tertiary education and technology education that were believed to lead a country to attain development in industry and thus in economy. So, sophisticated machinery was shipped from the developed countries to the developing countries in the form of development assistance. Effects of development, however, did not trickle down to the needy people within nation, and instead what spread out is ironically imbalance between the rich and the poor. Within this vision, the basic education was not fundamentally given much importance.

In 1970s, the second UN Development Decade, education expanded rapidly during this period (See table 1). For example, the enrolment rate in the Low income countries changed from 47.9 % in 1970 to 67.0 % in 1980.

At the same time, however, we experienced side effects of technological advancement such as industrial pollution and a sense of alienation. The assumptions of modernization theory, which were basis of technical transfer, started to be questioned and many alternative visions of development were proposed. For example, ILO proposed the concept of Basic Human Needs as an idea of minimum requirement of human beings, British economist, Schumach suggested appropriate technology against sophisticated and costly technology, and Dag Hammershold Foundation described an endogenous development as an alternative view of how society should develop itself. During this period, two oil shocks hit the world severely and most countries suffered from economic recession. It is in this context that the developing countries protested together for

more fair conditions of trades, which were called New International Economic Order. The developed countries, however, were not ready to accept those new ideas that might have led to formation of ownership by the developing countries.

Instead of them, the structural adjustment program was initiated by World Bank to focus on restructuring of financial institution at the wake of financial crisis. It swept into the developing countries in 1980s to slim down the extraordinarily swollen public sector and to introduce competition and efficiency into the fragile local market. Against its intention, the economic performance did not improve very much and the program affected low-income families most severely because of crude competition. As a result of cut off in the public expenditure especially in education, it suffered from qualitative deterioration as well as quantitative stagnation. As for the latter aspect, the same example of low income countries as in the previous case shows 67.0 % in 1980 to 67.3 % in 1985. That is why this period is called a lost decade in terms of development.

Recent movement

Up to 1980s, in economic development, there were some movements such as examination of modernization theory and introduction of structural adjustment program. On the other hand, which is believed to form basis of the economic development the tendency continued to focus on tertiary and technical institutions.

Dramatic turn occurred in 1990, which is an International Literacy Year. Four international organizations, World Bank, UNDP, UNICEF, and UNESCO, co-organized an international meeting on an education at Jomtien, Thailand. Although during the conference similar topics to those in 1960s has been taken up, the philosophical background for 1990s is based upon the same spirit as included in World Human Rights (1947) and the basic education has started to call more attention. The communiqué released after the conference is called World Declaration on Education for All (Abbreviated to EFA) and has influenced the course of international cooperation in education since then.

The phrase extracted from EFA was to show seriousness of the situation.

> More than 100 million children, including at least 60 million girls, have no access to primary schooling;
>
> More than 960 million adults, two thirds of whom are women, are illiterate, and functional illiteracy is significant problem in all countries, industrialized and developing;
>
> More than one-third of the world's adults have no access to the printed knowledge, new skills and technologies that could improve the quality of their lives and help them shape, and adapt to, social and cultural change;
>
> And More than 100 million children and countless adults fail to complete basic education programs;

> Millions more satisfy the attendance requirements but do not acquire essential knowledge and skills (UNESCO, 1990).

Considering these sentences, we recognize that the real target group by "all" is not rich people or selected few, but rather poor people or socially disadvantaged majority. Those people can neither attend to education nor acquire essential knowledge and skills even if they attend to it. Not only number but also content of education are at stake. Again from EFA,

> Knowing that education is an indispensable key to, though not a sufficient condition for, personal and social improvement; recognizing that traditional knowledge and indigenous cultural heritage have a value and validity in their own right and a capacity to both define and promote development; acknowledging that, overall, the current provision of education is seriously deficient and that it must be made more relevant and qualitatively improved, and made universally available (UNESCO, 1990)

Recognizing importance of traditional knowledge, its application to classroom is a key issue in considering the content, and otherwise it cannot promote development as stated. We are burdened with responsibility to realize it in educational practice.

In the year 2000, representatives from 164 countries all over the world congregated to renew their political commitments shown in EFA and released Dakar framework of action (UNESCO, 2000), in order to make sure of the actions to be taken definitely to tackle such crucial problems as high drop-out rate, disparity depending on sex, districts and economic status, which hinder prevalence of quality of education.

Significance of ethnomathematical research for international cooperation

Socio-cultural aspects of mathematics education

In the developing countries, the objectives of education in general and those of mathematics education in particular tend to have a special link to development and more specifically to industrialization. And many projects of Japanese international cooperation have been under operation since mid of 1990s in such countries as Kenya, Ghana, and Cambodia in mathematics and science education, where they intend to learn, if any, a strategy how Japan has made a dramatic success in industrializing society with high achievement in mathematics and science education. Here, mathematics is taken for granted to contribute to the development of industry and economy. On the other hand, the education in EFA is not necessarily the same as the one for industrialization under modernization theory, as discussed in the above.

Education is socio-cultural endeavor depending specific place and time, and different societies of different time can have different educational objectives. In reality, however, the objectives are somewhat similar if they are under assumption of modernization and the ultimate goal converges towards the industrialization. If this assumption itself is to be questioned, the societal and

cultural aspects as well as historical aspect become an important tool for reconsideration of objectives.

Even before the EFA (1990), the research community on mathematics education has already deliberated on "Mathematics for All", in which Nebres (1984) discussed horizontal and vertical relationships and cultural rootedness to explain the problem of education in a developing country. Here, horizontal relationships represent those within the country and vertical relationships represent those between the developing country and her ex-colonial country. It is important to clarify how to develop better horizontal fit and better rootedness in the socio-cultural context because each part of a developing society was transplanted vertically from the developed country without any interconnection with other parts of the society. And he claims that is why those segmented parts cannot work in an integrative manner, and this weakness is critical to the development of society.

Because of these reasons, it is important to consider mathematics education from socio-cultural aspects, and among many researches that tackle them, ethnomathematics forms an important stream. Besides, ethnomathematics comes out of opposition against modernization theory in the developing countries (Vithal & Skovsmose, 1997). So it, in reflection of developmental assumption, casts questions to foundation of education in the same background as shift in the international cooperation from education as human resource development in modernization theory to education as a human right manifested in EFA.

So, as a next step we shall consider relation between ethnomathematics and the EFA.

Ethnomathematical research for EFA

The declaration in EFA put the first priority on educational growth as an individual right caring his own culture, although it does not deny the economic and technological development, which may enable and strengthen other developments in return. As for the individual growth, the declaration describes basic learning needs in terms of learning contents such as literacy, oral expression, numeracy, and problem solving, and learning abilities such as knowledge, skills, values, and attitudes. So nurturing them in classroom is a crucial issue, and ethnomathematical research, which shares the same background as EFA, can provide substance to this basic learning needs.

Ethnomathematics has four strands, which are historical, anthropological, sociological, and educational researches (Vithal & Skovsmose, 1997) and the first three strands contain various examples. As pointed out in some researches, however, ethnomathematics itself is different from mathematical activities in education and its application to education requires something more than mechanical imitation of the activity. According to Baba & Iwasaki (1998), it is necessary not only to view mathematics education critically from ethnomathematics but also to view ethnomathematics critically in classroom.

Therefore, we analyze it from three components of educational process, namely objectives, contents and method.

The first one is to deal with the objectives of mathematics education. Critical nature of ethnomathematics against hegemony of western mathematics is strongly related to objective of mathematics education. Furthermore, the fact that many children do not learn mathematics in school regardless of mathematics abundant in daily life is a strong motive to reflect present education in terms of out-of-school mathematics.

The second one is to deal with mathematical practices outside school as contents of mathematics. There are ample examples of ethnomathematics (e.g. Gerdes, 1990, Ascher, 1991). And other researches (e.g. Carraher,T.N. et al, 1985) show that there is a gap between school mathematics and mathematics outside classroom. For example some children, who are very efficient at calculating on the streets, cannot solve the problems, which are mathematically equivalent calculations, in the classroom.

The clearer objectives and contents of mathematics education based on ethnomathematics become, the more important the method of how to develop it in classroom. Or rather, instead of considering it in this fragmented manner, the whole educational process inspired by ethnomathematics is yet to be clarified.

Verb-based curriculum

As stated in the above, non-critical nature of ethnomathematics to itself is a weakness in application to education. On the other hand, it contains strong message to view the present mathematics education critically. Therefore, verb-based curriculum is introduced to overcome this weakness in development of mathematics education based on ethnomathematics. Knowledge is formed as a result of activity on the environment. Since the former is expressed in noun form and the latter in verb form, knowledge focused curriculum is called noun-based curriculum. So, in the verb-based curriculum, the activity is given more stress on as a source of knowledge.

Baba (2000, 2001) has analyzed all verbs in the Japanese course of study (1989) and the Kenyan syllabus (1992) for primary education, and described the process in terms of development of mathematical activities. This intends to utilize ethnomathematics as a classroom activity to define the educational process in the above.

For example, development of measuring activity is shown in the below table although one stage of activity does not necessarily correspond with one grade. Major verbs for measuring activity are common to two curricula. This can be interpreted as showing universality of mathematical activity (Bishop, 1991), which exists irrespective of cultures. On the other hand, there are few differences as follows.

1 In Japanese course of study, there are internal activities such as understand and know.

2 In Kenyan syllabus, there are manipulative operations as basic measuring activity.
3 At the last stage of Kenyan syllabus, solving problem is an integrative activity to utilize knowledge and skills learned previously.

Japan	Kenya
(1) Pre-measuring activity	
Compare (internal activity)	Comparison, use
(2) Basic measuring activity 1	
Measure (understand, know)	Measuring, establishing, counting, making
(3) Basic measuring activity 2	
Choose appropriately, use, represent (know(about unit))	Introducing, operations
(4) Approximation in measuring	
Approximately be represented, estimate (deepen, develop)	Estimating, finding, converting
(5) Integrative activity	
Measure (through experiment) (know (how to measure), understand (relationship))	Solving

Table 2 Development of measuring activity

The basic learning needs in the EFA comprise learning contents and abilities. The latter contains skills, knowledge, value and attitudes, and in verb-based curriculum not only skills and knowledge but also affective aspects such as value and attitudes are to be nurtured by linking cultural activities with classroom activities.

Conclusion

The mathematics education was and still is somewhat regarded as a key to technological and economic development, especially for the developing countries. On the other hand, ethnomathematics is unavoidably related to well-being of society since it requires reviewing objectives of the present mathematics education by posing different view of mathematics in education.

Thus ethnomathematics poses two issues for international cooperation;

- to provide a forum to think about various ways of development besides modernization theory, and

- to realize basic learning needs stated in EFA.

The second one was discussed in this paper and verb-based curriculum was proposed for realization of mathematics education based on ethnomathematics in classroom. Empirical examination against this curriculum is a future issue for research.

What is important in general for the research area to be fruitful is to open up the discussion from various angles. In this paper the international cooperation is regarded as a forum to discuss educational issues across cultures. It is neither just a compulsion of values by one side upon the other side, nor avoidance of discussion with it. It should be a beginning of consideration about specificity and universality of cultural mathematics and education, and simultaneously about global issues towards attainment of Education for All.

For example, application of daily activity into classroom promotes reflection on it, although it is unconsciously done in daily life. Since the activity originated from within culture, it is specific to the culture, but at the same time cultural activities contain some universality (Bishop, 1991). As for relationship of mathematical activities and global issues, especially development, ethnomathematics share the same background as the EFA and development of mathematical activity should promote endogenousness of people and society in development only through individual growth in terms of basic learning abilities.

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